

Waste Characterization

Table 2-1. Coal-Fired Utility Large-Volume Wastes: Fly Ash Total Concentration Data (ppm)								
Data Source	Constituent	Number of Samples	Number of Non-Detects	Number of Sites	Mean	Minimum	Maximum	Median
Tetra Tech ^a (Mech. Hopper Ash)	Arsenic	n/a	n/a	n/a	n/a	3.3	160	25.2
	Barium	n/a	n/a	n/a	n/a	52	1152	872
	Boron	n/a	n/a	n/a	n/a	205	714	258
	Cadmium	n/a	n/a	n/a	n/a	0.40	14.3	4.27
	Chromium	n/a	n/a	n/a	n/a	83.3	305	172
	Cobalt	n/a	n/a	n/a	n/a	6.22	76.9	48.3
	Copper	n/a	n/a	n/a	n/a	42.0	326	130
	Fluorine	n/a	n/a	n/a	n/a	2.50	83.3	41.8
	Lead	n/a	n/a	n/a	n/a	5.2	101	13.0
	Manganese	n/a	n/a	n/a	n/a	123	430	191
	Mercury	n/a	n/a	n/a	n/a	0.008	3.00	0.073
	Selenium	n/a	n/a	n/a	n/a	0.13	11.8	5.52
	Silver	n/a	n/a	n/a	n/a	0.08	4.0	0.70
	Strontium	n/a	n/a	n/a	n/a	396	2430	931
	Vanadium	n/a	n/a	n/a	n/a	100	377	251
Zinc	n/a	n/a	n/a	n/a	56.7	215	155	
Tetra Tech ^b (Fine Fly Ash)	Arsenic	n/a	n/a	n/a	n/a	2.3	279	56.7
	Barium	n/a	n/a	n/a	n/a	110	5400	991
	Boron	n/a	n/a	n/a	n/a	10.0	1300	371
	Cadmium	n/a	n/a	n/a	n/a	0.10	18.0	1.60
	Chromium	n/a	n/a	n/a	n/a	3.6	437	136
	Cobalt	n/a	n/a	n/a	n/a	4.90	79.0	35.9
	Copper	n/a	n/a	n/a	n/a	33.0	349	116
	Fluorine	n/a	n/a	n/a	n/a	0.40	320	29.0
	Lead	n/a	n/a	n/a	n/a	3.10	252	66.5
	Manganese	n/a	n/a	n/a	n/a	24.5	750	250
	Mercury	n/a	n/a	n/a	n/a	0.005	2.50	0.10
	Selenium	n/a	n/a	n/a	n/a	0.60	19.0	9.97
	Silver	n/a	n/a	n/a	n/a	0.04	8.0	0.501
	Strontium	n/a	n/a	n/a	n/a	30.0	3855	775
Vanadium	n/a	n/a	n/a	n/a	11.9	570	248	

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Data Source	Constituent	Number of Samples	Number of Non-Detects	Number of Sites	Mean	Minimum	Maximum	Median
	Zinc	n/a	n/a	n/a	n/a	14.0	2,300	210

Table 2-1. Coal-Fired Utility Large-Volume Wastes: Fly Ash Total Concentration Data (ppm) (continued)

Data Source	Constituent	Number of Samples	Number of Non-Detects	Number of Sites	Mean	Minimum	Maximum	Median
1993 Data ^c	Antimony	46	35	n/a	10.5	0.2	205	4.6
	Arsenic	81	3	n/a	76.4	0.0003	391.0	43.4
	Barium	74	3	n/a	1589	0.02	10850	806.5
	Beryllium	12	0	n/a	201.8	0.200	2105	5.0
	Boron	27	0	n/a	469.5	2.98	2050	311
	Cadmium	66	41	n/a	6.1	0.0100	76.0	3.4
	Chromium VI	83	8	n/a	129	0.19	651	90
	Copper	78	1	n/a	123	0.20	655	112
	Lead	76	2	n/a	67.0	0.02	273	56.8
	Mercury	27	7	n/a	4.3	0.013	49.5	0.1
	Nickel	71	0	n/a	117.5	0.1	1270	77.6
	Selenium	81	16	n/a	8.7	0.0003	49.5	7.7
	Silver	62	42	n/a	3.7	0.01	49.5	3.2
	Thallium	11	4	n/a	19.2	0.15	85.0	9.0
	Vanadium	61	5	n/a	397	43.5	5015	252
Zinc	79	0	n/a	286.5	0.28	2200	148	

^a Mechanical hopper fly ash data from Tetra Tech (1983) and presented in the 1988 Report to Congress

^b Fine fly ash data from Tetra Tech (1983) and presented in the 1988 Report to Congress

^c Data from supporting documentation to the 1993 Regulatory Determination; values below the detection limit were treated as one-half the detection limit

n/a = data not available

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Table 2-2. Coal-Fired Utility Large-Volume Wastes: Bottom Ash Total Concentration Data (ppm)

Data Source	Constituent	Number of Samples	Number of Non-Detects	Number of Sites	Mean	Minimum	Maximum	Median
Tetra Tech ^a	Arsenic	n/a	n/a	n/a	n/a	0.50	168	4.45
	Barium	n/a	n/a	n/a	n/a	300	5789	1600
	Boron	n/a	n/a	n/a	n/a	41.9	513	161
	Cadmium	n/a	n/a	n/a	n/a	0.1	4.7	0.86
	Chromium	n/a	n/a	n/a	n/a	3.4	350	120
	Cobalt	n/a	n/a	n/a	n/a	7.1	60.4	24
	Copper	n/a	n/a	n/a	n/a	3.7	250	68.1
	Fluorine	n/a	n/a	n/a	n/a	2.5	104	50.0
	Lead	n/a	n/a	n/a	n/a	0.4	90.6	7.1
	Manganese	n/a	n/a	n/a	n/a	56.7	769	297
	Mercury	n/a	n/a	n/a	n/a	0.005	4.2	0.023
	Selenium	n/a	n/a	n/a	n/a	0.08	14	0.601
	Silver	n/a	n/a	n/a	n/a	0.1	0.51	0.20
	Strontium	n/a	n/a	n/a	n/a	170	1800	800
	Vanadium	n/a	n/a	n/a	n/a	12.0	377	141
Zinc	n/a	n/a	n/a	n/a	4.0	798	99.6	
1993 Data ^b	Antimony	36	35	n/a	4.1	0.18	8.4	4.0
	Arsenic	48	5	n/a	7.7	0.80	36.5	4.7
	Barium	46	1	n/a	1526	24	9360	633
	Beryllium	2	0	n/a	2.2	1.4	2.9	2.2
	Boron	11	0	n/a	109.9	1.79	390	90.0
	Cadmium	48	38	n/a	2.7	0.050	5.5	3.1
	Chromium VI	48	4	n/a	411	3.41	4710	121.0
	Copper	48	0	n/a	61.4	2.39	146.3	61.1
	Lead	48	1	n/a	35.0	0.86	843.0	13.2
	Mercury	12	7	n/a	0.013	0.003	0.040	0.009
	Nickel	48	1	n/a	161.2	1.9	1267	79.6
	Selenium	48	31	n/a	1.1	0.0070	9.0	0.8
	Silver	40	33	n/a	3.0	0.06	7.1	3.0
	Thallium	1	0	n/a	---	2.0	2.0	---
	Vanadium	37	7	n/a	143.1	24.0	264	141
Zinc	48	0	n/a	123.1	3.80	717	52.6	

^a Bottom and boiler slag (combined) data from Tetra Tech (1983) and presented in the 1988 Report to Congress

^b Data from supporting documentation to the 1993 Regulatory Determination; values below the detection limit were treated as one-half the detection limit

n/a = data not available

--- = too few data points to calculate statistics

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Table 2-3. Coal-Fired Utility Large-Volume Wastes: Boiler Slag Total Concentration Data (ppm)

Constituent	Number of Samples	Number of Non-Detects	Number of Sites	Mean	Minimum	Maximum	Median
Antimony	3	0	n/a	0.7	0.25	1.0	0.8
Arsenic	15	7	n/a	23.0	0.01	254.0	4.5
Barium	15	7	n/a	698.7	6.19	1720	413
Beryllium	3	0	n/a	7.0	7.0	7.0	7.0
Boron	5	2	n/a	31.7	0.10	55.0	49.5
Cadmium	15	11	n/a	22.4	0.01	40.5	40.5
Chromium VI	15	1	n/a	592.1	1.43	5981	158
Copper	15	2	n/a	52.0	1.37	156	32.0
Lead	15	6	n/a	34.6	0.40	120.0	8.0
Mercury	15	15	n/a	5.1	0.016	9.5	9.5
Nickel	15	2	n/a	81.4	3.3	177	83.0
Selenium	14	8	n/a	4.8	0.010	14.0	4.5
Silver	15	13	n/a	22.2	0.01	74.0	37.0
Thallium	3	0	n/a	37.3	33.5	40.0	38.5
Vanadium	11	7	n/a	146.1	75.0	320.0	75.0
Zinc	15	2	n/a	79.2	4.43	530	35.8

n/a = data not available

Source: Data from supporting documentation to the 1993 Regulatory Determination; values below the detection limit were treated as one-half the detection limit

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Table 2-4. Coal-Fired Utility Large-Volume Wastes: FGD Waste Total Concentration Data (ppm)

Constituent	Number of Samples	Number of Non-Detects	Number of Sites	Mean	Minimum	Maximum	Median
Antimony	31	25	n/a	15.8	3.65	90.0	6.0
Arsenic	36	5	n/a	53.6	0.0075	341.0	32.5
Barium	35	3	n/a	352.1	0.08	2280	162.5
Beryllium	14	7	n/a	27.7	0.900	49.5	29.3
Boron	18	11	n/a	144.8	5.00	633.0	60.0
Cadmium	36	22	n/a	19.2	0.005	81.9	3.9
Chromium VI	36	5	n/a	90.7	0.17	312.0	73.0
Copper	36	0	n/a	62.4	0.04	251.0	46.1
Lead	34	2	n/a	121.7	0.01	527.0	25.3
Mercury	15	7	n/a	5.2	0.073	39.0	4.8
Nickel	35	1	n/a	72.5	3.7	191.0	68.1
Selenium	34	9	n/a	12.1	0.0150	162.0	4.5
Silver	29	20	n/a	3.5	0.01	10.3	3.3
Thallium	6	6	n/a	9.0	9.0	9.0	9.0
Vanadium	33	16	n/a	104.9	0.01	302.0	65.0
Zinc	36	1	n/a	921.0	0.01	5070	90.9

n/a = data not available

Source: Data from supporting documentation to the 1993 Regulatory Determination; values below the detection limit were treated as one-half the detection limit

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Table 2-7. Coal-Fired Utility Comanaged Wastes: Total Concentration Data for Wastes Comanaged in Landfills (ppm)

Constituent	Number of Samples	Number of Non-Detects	Number of Sites	Mean	Minimum	Maximum	Median
Arsenic	6	0	3	20	6.2	38	16
Barium	6	0	3	2,900	1,800	3,800	3200
Cadmium	6	6	3	Not calculated*			
Chromium	6	2	3	50	35	78	38
Copper	6	0	3	105	97	120	99
Lead	6	1	3	17	6.5	29	16
Nickel	6	0	3	51	33	65	54
Selenium	6	3	3	14	0.8	32	9.1
Silver	6	5	3	Not calculated*			
Vanadium	6	0	3	86	23	160	77
Zinc	6	3	3	84	35	160	53

* The constituent was not detected in any samples or detected in a small number of samples; therefore, meaningful statistical values cannot be calculated.

Notes: All measurements identified as below detection limit were assigned a value equal to one-half the detection limit for use in the calculations. All concentrations are facility-averaged; i.e., multiple measurements from a single site are averaged, and the resulting population of facility averages used to generate the statistics in this table.

Source: EPRI Comanagement data. Includes wastes sampled within the landfills.

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Table 2-8. Coal-Fired Utility Comanaged Wastes: Total Concentration Data for Wastes Comanaged in Surface Impoundments (ppm)

Constituent	Number of Samples	Number of Non-Detects	Number of Sites	Mean	Minimum	Maximum	Median
Antimony	26	24	7	Not calculated*			
Arsenic	45	9	15	40	6.7	150	18
Barium	45	6	15	1,600	150	8,400	510
Beryllium	11	0	3	8.4	0.88	16	8.3
Boron	15	6	5	190	0.03	420	140
Cadmium	45	36	15	6.0	0.20	24	5.4
Chromium	45	17	15	85	5.7	290	86
Cobalt	17	6	4	29	4.7	42	34
Copper	45	2	15	78	2.2	150	86
Lead	45	5	15	42	5.0	150	24
Nickel	45	6	15	68	1.5	160	71
Selenium	45	17	15	37	0.025	320	6.6
Silver	39	30	14	5.2	0.03	14	5.3
Thallium	11	1	3	27	10.6	48	23
Vanadium	45	21	15	120	20	350	60
Zinc	45	0	15	150	17	860	79

* The constituent was detected only in a small number of samples; meaningful statistical values cannot be calculated.
 Notes: All measurements identified as below detection limit were assigned a value equal to one-half the detection limit for use in the calculations. All concentrations are facility-averaged; i.e., multiple measurements from a single site are averaged, and the resulting population of facility averages used to generate the statistics in this table.
 Source: EPRI Comanagement data. Includes wastes sampled from within the impoundments.